REVISTA

DE LA

Sociedad Entomológica Argentina

Tomo X - No. 2 20 de Noviembre de 1939 Año 1939

THE STATUS AND RELATIONSHIP OF THE NEOTROPICAL GENUS *SCYLLINOPS* (*ORTHOPTERA, ACRIDIDAE, ACRIDINAE*)

by

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In a recent paper (1) Dr. B. P. Uvarov, of the British Museum of Natural History, has called attention to the need of correlating the generic classifications of the Acrididae which have, as he expressed it, "developed independently in the New and the Old World". As one of the workers in that field I am quite in accord with Dr. Uvarov's feeling that there has been a lack of coordination, the chief reason for which probably has been that virtually no collection of Acrididae assembled in the past has been sufficiently comprehensive in itself to permit these very essential revisionary studies.

The imperative need for such work has in recent years been increasingly evident, and the students of the Orthoptera located in Philadelphia have consulted with one another many times over problems with this background. Some of their conclusions on correla-

(1) "Two South American Acridid Genera with Old World Affinities (Orthoptera)". Revista Soc. Entom. Argent., IX, pp. 3-5, (1937).

tions have been published (2), and others, brought forward sometimes by Old World workers' disregard of New World associations or affinities, will be presented in the near future. One of the recent studies with ignored many of the potential ramifications of the problem discussed in it was Dovnar's study of the Palaearctic Podismini (or Melanopli as American workers have called the group for over forty years) (3). No reference was made in Dovnar's work to the far greater and much more diverse series of genera of that group found in the New World, although certain of them are now known to be Holarctic, and others have been so considered in the literature of the past.

The essential need in all such correlation work is that we "make haste slowly", and have all of our conclusions on solid foundations, or instead of clearing up inconsistencies and pointing out errors, we may present merely controversial personal opinions, without the substantial support which is needed to supplant conclusions already drawn by others. It is always desirable to present the evidence on which we differ from our predecessors or colleagues, not only for our own sense of duty, but for the consideration of students of the subject who may desire to convince themselves de novo as to which argument, or which conclusion, has the sounder base.

In the paper by Uvarov referred to in the leading paragraph, he has made the definite statement that the South and Central American genus *Scyllinops* Rehn (4) is a synonym of the genus *Aulacobothrus* I. Bolívar, (5) which latter he considers to be a devrsified entity known from India and Africa, and, by his new synonymy, much of America as well. Colleagues elsewhere have asked me to comment on this action and, without any desire to do more than express my conclusions, based on a re-examination of the question, the present discussion, with appended remarks on Neotropical biotics, is submitted.

The genus *Scyllinops* had as its genotype *Stirapleura bruneri* Rehn, and in it also were placed *Stirapleura pallida, salina, variabilis* and *obscura* Bruner, *Oedipoda humilis* and *signatipennis* Blanchard, all

(2) "On New or Redefined Genera of Neartic Melanopli (Orthoptera: Acrididae)". By James A. G. Rehn and John W. H. Rehn. Trans. Amer. Entom. Soc., LXII, pp. 1-30, pls I and II, (1936). The discussion of Dovnar's work, referred to above, is on pages 2 to 5.

(3) "Zur Kenntnis der paläarktischen Podismini". Travaux Inst. Zool. Acad. Sci. URSS., I, pp. 253-268, 5 text-figs., (1933). In Russian with a German summary).

(4) Trans. Amer. Entom. Soc., LIII, p. 228; (1927).

(5) Ann. Soc. Entom. France, LXX, p. 597, (1902).

Argentine or Chilean forms except *salina*, which is from southern Mexico. It is unnecessary to stress these species further than to mention that material of all was examined when the genus was erected, this consisting of types or paratypes of all except the Blanchard species.

The genus *Aulacobothrus* was based on four Indian species, i. e. *strictus, socius, infernus* and *taeniatus,* all described as new by Bolívar when the genus was erected, and of which *strictus* was later selected as the genotype by Kirby (6). Subsequently numerous previously known or new African species were referred to *Aulacobothrus,* although certain of them had been sperated generically by I. Bolívar, under the genus *Phorenula.*

It is particularly important in considering Uvarov's argument, which is rather short in its disposal of counter-evidence, to remember that the actual base of *Aulacobothrus* must be the Indian species *A. strictus,* and that no one of the African forms since placed in the genus was then known to Bolívar, yet the possible occurrence of true *Aulacobothrus* in Africa had not been questioned. Further, it was the original describer of the latter genus who later considered certain African forms sufficiently distinct to erect the genus *Phorenula.*

Of the genus *Aulacobothrus* Bolívar, in the Old World sense, I have before me determined five Indian species and thre African ones, as well as a considerable series from both areas still to be critically studied. The determined Indian species examined in this connection are: *strictus* Bolívar (the genotype), a topotypic ♀; *socius* Bolívar, ♂ and ♀ topotypes; *infernus* Bolívar, 1 ♀; *luteipes* (Walker), 1 ♂ determined by Uvarov; *decisus* (Walker), 2 ♀ (which species has been considered the same as *socius* by Uvarov, but with Hebard I feel this is incorrect). The African species before me are: *vittatus* Uvarov, 1 ♀ determined by Uvarov; *punctatus* Uvarov, 1 ♀ paratype; *wernerianus* (Karny), 1 ♂, 1 ♀ received from the British Museum of Natural History and apparently determined by Uvarov.

From the evidence of these eight Old World determined species it seems definite that more than a single generic entity is represented, the general pronotal form as well as that of the caudal femora pointing toward two distinct categories. Both types occur in Africa, and one of these may be Bolívar's *Phorenula* (7), which Uvarov has

(6) Synon. Cat. Orth., III, p. 189, (1910).

(7) Boletín R. Soc. Españ. Hist. Nat., IX, p. 296, (1909), (no included species given). Mém. Soc. Entom. Belg., XIX, pp. 81, 82, (1911), (included P. *dorsata* and *cruciata* new species, former selected as genotype by Uvarov, 1921).

synonymized under *Aulacobothrus*. At the moment I am not concerned with this angle of the problem, but solely with the relationship of true *Aulacobothrus*, and inferentially the other entity, with the New World *Scyllinops*.

When *Scyllinops* was originally described I tabulated and keyed the species then placed in the genus, and listed or gave references to prior records of the material seen of each of the species. Certain of these specific series in the Philadelphia collections have since been materially increased in size, and in addition we now know that Bruner's *Gomphocerus meridionalis* (8), the type of which, in the Hebard Collection, now before me, is a species of *Scyllinops*.

From the representation of *Aulacobothrus* and *Scyllinops* mentioned above, I have drawn the following conclusions as to the features of the two generic entities.

In both sexes of *Scyllinops* we find the pronotum definitely strangulate as viewed from the dorsum, a condition much more weakly or not at all indicated in true *Aulacobothrus;* the head in most species of *Scyllinops* is definitely heavier and broader across the genae in proportion to its more dorsal width, than in *Aulacobothrus*, this less evident in *Scyllinops humilis* than in the other members of the genus; the internal calcaria in *Scyllinops* show a very marked difference in their length, the shorter being no more than two-thirds as long as the longer, while in *Aulacobothrus* the shorter is four-fifths as long as the other, in addition in *Scyllinops* the longer calcar is briefly but definitely and sharply hooked at the apex, with the shank as a whole straighter, instead of more evenly falcate throughout, as in the Indian forms of *Aulacobothrus* seen. In males of *Scyllinops* the area of the tegmina between the ulnar veins is never fenestrate by transverse regularly disposed nervures dividing it into even "panes", as in males of Indian species of *Aulacobothrus* seen, such fenestration as may be present in *Scyllinops* always being relatively irregular.

The female sex of *Scyllinops*, in addition to features mentioned for both sexes, has the frontal costa regularly narrowing dorsad, instead of being broader with subparallel margins in the median portion of its depth, as in *Aulacobothrus*.

Examining the relationship of *Scyllinops* anew, without considering or being prejudiced by prior statements or expressions of opinion, it is evident to me that the closest affinity is with the North American

(8) Biol. Cent.-Amer., Orth., II, p. 93, (1904), [♀; Cuernavaca, Morelos, México].

and Mexican genus *Psoloessa* Scudder (9), of which *Stirapleura* Scudder (10 is a synonym, as Hebard pointed out in 1928 (11). Having in part completed an exhaustive study of the forms of *Psoloessa,* based on some thousands of specimens, I am reasonably familiar with the range of specific features found in that genus (12). These are very considerable, with the extreme at one end of the series more nearly related to *Scyllinops* than that at the opposite pole of the arrangement. In the features here listed as separating *Scyllinops* from true *Aulacobothrus* we find *Psoloessa and Scyllinops* in agreement, and both distinguishable from the genotype of *Aulacobothrus.* Some of the African species examined are less markedly distinguished from the two former genera, but no less so from *Scyllinops* than from *Psoloessa,* and any argument for synonymizing the former genus, on account of apparent plasticity in what may be considered forms of *"Aulacobothrus",* brings into prominence the prior establishment of the generic name *Psoloessa.* In the latter genus we have marked plasticity in its half dozen forms, certain of which are subspecies with intergradation definitely known from extensive series representing continuous areas of distribution.

The relationship of *Scyllinops* with *Scyllina* discussed by me when the former was erected remains definite, but is secondary to that with *Psoloessa,* which latter affinity is also further attested by Bruner's earlier reference of *Scyllinops* species to the synonymic *Stirapleura.* It is clear to me that *Psoloessa* and *Scyllinops* have a common ancestry, yet distributionally they are almost entirely complementary, their ranges but narrowly overlapping. Their differential features will be discussed at a later date in the study of *Psoloessa* mentioned above.

I am obliged to differ regarding several sweeping statements made by Uvarov in his discussion of the *Scyllinops - Aulacobothrus* matter. One of these is that "The genotype of *Scyllinops,* which is *S. bruneri* (Rehn), if found in Africa, would have been included into (in) *Aulacobothrus* without any hesitation." It might have been in the hodge-podge which appears in the literature as *Aulacobothrus* from Africa, but not in the more restricted entity to which *A. strictus* Bolívar, the

(9) Proc. Boston Soc. Nat. Hist., XVII, p. 512, (1875). Genotype, *P. texana* Scudder.

(10) Bull. U. S. Geol. Surv. Terr., II, N.° 3, p. 263, (1876). Genotype, *S. delicatula* Scudder.

(11) Proc. Acad. Nat. Sci. Phila., LXXX, p. 231.

(12) The description of a new subspecies of *Psoloessa delicatula* has been published in advance of the main study. See Trans. Amer. Entom. Soc., LXIII, pp. 325-332, (1937).

Indian topotype belongs. The other point is due to a misquotation, or at least a wrong inference, drawn from my original comments on *Scyllinops*. Uvarov says, "The only character of apparent generic value may be found in the shape of the posterior margin of the female subgenital plate which in that species (i. e. *bruneri)* and in *pallida* Bruner is strongly trilobate. This character is included by Rehn into (in the) generic diagnosis but it is very little pronounced in *signatipennis* (Blanch.), *humilis* (Blanch.), *variabilis* (Brun.) and *obscura* (Brun.) which all belong to *Scyllinops* according to that author...". I did not give "trilobate" for this plate as a diagnostic generic character. What I did present as one of a number of coordinate features in the generic description (p. 229) was; "Distal abdominal sternite of female with its caudal margin triundulate, having a median and paired lateral extensions between and around ventral ovipositor jaws." This states exactly the idea I meant to convey, and the key to the species given by me on pages 231 to 233 of the 1927 paper will show that the word "triundulate" was used advisedly, as the details of this character of the sternite vary specifically within the scope of the wording used in the generic description. Checking the females of all the known forms of *Scyllinops* again, I find no reason to modify the previous statement. An examination of my original text will show, therefore, that a "trilobate" distal margin to the ultimate sternite of the female sex of *Scyllinops* was not given or considered by me as a generic character, and the characters used in my key to the species will most definitely testify this exact type of structure was never considered of generic worth. There is, it should be noted, a definite degree of difference between "triundulate" and "trilobate". It is quite conceivable that Old World species of *Aulacobothrus* or related genera may have trilobate margins to this sternite, especially as I have already shown three types of marginal shape occur in *Scyllinops,* but all of the latter would be embraced in the term "triundulate".

To summarize: (a) *Scyllinops* is less closely related to true *Aulacobothrus (A. strictus)* than it is to the North American genus *Psoloessa*; (b) any disposal of *Scyllinops* without full consideration of *Psoloessa* is ignoring natural affinities; (c) at least certain of the African forms which have been referred to *Aulacobothrus* are not congeneric with *A. strictus,* the genotype, although true *Aulacobothrus* apparently does occur in Africa; (d) the assertion by Uvarov that the sole feature originally given for *Scyllinops,* which he considers of generic value, does not hold for the genus, is based on a misreading or misinterpretation of the original generic description of *Scyllinops.*

As to the generic identity of Neotropical and Old World, but particularly African, Orthoptera, I feel we will find a certain amount of it, as our knowledge becomes more comprehensive. I do not, however, look for African affinities in southern South America, but instead should expect them, if they materialize, to occur in the more tropical areas. The reasons for this are many, involved and controversial, and hardly in place here, but may be discussed at some future time.

The discontinuous distribution of *Scyllinops* is by no means unique in the Neotropical Realm, and we have quite a few cases of parallelisms as extreme or as surprising as that of *Scyllinops*. The mantid genus *Brunneria* has a number of species in southern Brazil, Argentina, Paraguay and southeastern Bolivia, and a single one in Texas and adjacent states in the southern United States. The acridid genus *Dichromorpha,* a dominant type of the eastern and southern United States and with several species in México, has a single species in northern Argentina and adjacent areas. In the vast territory stretching between, and covering almost forty degrees of latitude, both genera are absent, although preferred habitats are extensively represented, and a great deal of field work, some by trained orthopterists, has been done there in the last forty years.

Somewhat akin is the absence of the dominant New World oedipodine genus *Trimerotropis* from the great area reaching from southern Mexico to Ecuador, although the northern and southern limits of the genus are Canada on one hand and Patagonia on the other. Knowing this genus well from long and varied experience in the western United States, and with its habitat preferences a matter of personal investigation, I have looked vainly for it in parts of Colombia and areas of Central America where I had reason to expect its occurrence. The cyrtacanthacridine group Melanopli, with approximately fifty genera in the New World, has three great centers of pronounced differentiation in that hemisphere, one in North America and México, a second in the montane areas of Colombia and Venezuela (with nearly complete endemism), and a third in southern Brazil, Paraguay, eastern Bolivia and the northern Argentine. When compared with these centers, each with definite groups of endemic genera, we find in Central America between the Mexican-Guatemalan boundary, and Colombia but two genera are represented and each by a single form, while over the vast lowlands of northeastern South America but a single genus, and probably but a single species, of the group is known to occur.

These cases, which can to varying degrees be paralleled in other groups of animals, clearly demonstrate reactions to controls or inhibitions with a background of similarity, and to this extent the close relationship of *Scyllinops* and *Psoloessa* is in essential agreement with the affinity of numerous North American genera on one hand and other more uniformly distributed South and Central American genera on the other.

It cannot be affimed too strongly that the Neotropical Realm, as the evidence in many groups of animals and particularly vertebrates, so clearly demonstrates, is a vast and ancient center of differentiation, which faunistically has produced in group after group a greater endemism in genera and families than any other large area of the world, except Australasia. The Nearctic Realm at various times received certain quotas of this, when the Central American land-bridge was periodically re-established. Along with these, wave after wave from the Palearctic brought to the Nearctic, and the Nearctic in turn gave to the Palearctic, the various elements in common which give substance to the zoogeographic term Holarctic. At the same time in the Nearctic there developed the definite and pronounced endemic Sonoran element, which today so strongly colors the whole life of central and northern México, as well as that of the southwestern, much of the southeastern and even of the eastern parts of the United States.

As for the pronounced endemism of the present Neotropical biota the paleontological panorama gives and overwhelming amount of supporting evidence. One cannot fail to be impressed by some very recently expressed generalizations of one of the most distinguished of paleo-botanists, Dr. Edward W. Berry. In summarizing the results of his study of the extensive Lower Miocena flora of the Rio Pichileufu, Patagonia, Dr. Berry states; "One of the most striking features of this flora (which represents 99 genera of 87 families and 28 orders) is its typically American character". He further observes, "It would be expected that the Rio Pichileufu flora would show some similarity with the African flora if there were any basis for the Wegener and other hypotheses of continental drift. As I have frequently stated, I can see no evidence for these speculations in any of the Tertiary floras of South America. These floras are quite as typically South American as the present floras of that continent." Of decided interest to zoologists is this summation of a situation which has some bearing

(13) Scientific Monthly, XLVIII, pp. 51-60, (Jan. 1939).

on the immediate subject of this article, i. e.; "Patagonia to day is practically treeless, whereas the inter-Andean valleys and the south of Chile are covered with dense forests... We now know that a large number of trees, whose descendants have only survived in the wet Chilean region, were present in Patagonia for several millennia and disappeared from that region in geologically very modern times after the Andes had reared their bulk across the moisture-laden 'roaring forties' and thus desiccated Patagonia."

When we know in greater detail the late Pliocene and Pleistocene history and climatology of the Americas, we probably will have a full explanation of questions such as the origin and relationship of *Scyllinops,* and many similar ones familiar to those who are interested in the American fauna as a whole. Geological evidence from many sources is clearly indicative of a definitely lower temperature over the more tropical areas of South and Central America during at least some of the Pleistocene period. A one-time broader distribution of grassland, either humid or desert, would have provided migration or flow avenues non-existent today, and the New World Orthoptera which exhibit the cases of completely or partially discontinuous distribution are largely grassland or savanna forms, and not forest or swamp-land species.